

PATENT

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FOR

CLAIM ASSESSMENT MODEL

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CLAIMS ASSESSMENT MODEL

This application claims the benefit of U.S.
Provisional Application 60/126,975, filed March 30, 1999,
U.S. Provisional Application 60/137,037, filed June 1,
1999, and U.S. Provisional Application 60/171,224, filed
5 December 16, 1999.

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Background of the Invention

The present invention relates to claims adjustment,
worker's compensation claims and common law claims.
20 Traditionally, an adjuster in a workers' compensation case
receives a claimant's medical information from a physician,
employer, hospital or other medical provider, assesses
whether the claimant will be able to return to work and, if
so, assesses how long the claimant will be out of work.
25 Based on this assessment, the adjuster assesses the
potential cost to the insurer and employer. A similar
process occurs where the claim, or potential claim, arises
outside a workers' compensation system. There, the
adjuster assesses the potential liability under "common

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law" recovery systems. The adjuster's decisions are based on experience, available historical medical reference data and available historical liability data, as should be
5 understood in this art.

The claimant data and medical data may include the claimant's name, age, sex, occupation, injuries, preexisting conditions, treatments, complications and prognoses. In workers' compensation cases, the adjuster considers the
10 claimant's job requirements in light of the medical data to determine if and when the claimant will return to work. In common law cases, the adjuster considers the claimant's medical conditions in light of historical liability data to assess the common law
15 liability for those conditions.

Summary of the Invention

The present invention recognizes and addresses disadvantages of prior art methods.

Accordingly, it is an object of the present invention
20 to provide an improved method of assessing workers' compensation insurance claims and common law claims.

This and other objects are achieved by a computerized method for assessing medical conditions affecting a person. The method includes providing a plurality of profiles
25 relating predetermined medical conditions to human body parts. Each profile describes an estimated capacity of at least one body part, due to at least one condition, over time. One or more of the predetermined medical conditions that affect the person are identified. A profile
30 corresponding to each identified medical condition is selected, and each selected profile's time dimension is related to the occurrence of its medical condition.

In another embodiment, a computerized method for

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Brief Description of the Drawings

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Figure 2 is an exemplary table of data classes for use in an embodiment of the present invention;

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Figure 4 is a table illustrating an exemplary medical condition profile for use in an embodiment of the present invention;

Figure 5 is a table illustrating an exemplary medical condition profile for use in an embodiment of the present invention;

Figure 6 is a table illustrating an exemplary medical condition profile for use in an embodiment of the present invention;

Figure 7 is a table illustrating an exemplary medical condition profile for use in an embodiment of the present invention;

Figure 8 is an exemplary graphical representation of a medical condition profile for use in an embodiment of the present invention;

Figure 9 is a graphical illustration of an exemplary modification to the profile in Figure 8 according to a recovery prognosis;

Figure 10 is a graphical illustration of an exemplary modification to the profile in Figure 8 according to a recovery prognosis;

Figure 11 is an exemplary prognosis table for use in an embodiment of the present invention;

Figure 12 is an exemplary prognosis table for use in an embodiment of the present invention;

Figure 13A - 13D is a flow chart illustrating a workers' compensation assessment method according to an embodiment of the present invention;

Figure 14 is a graphical representation of medical condition profiles applicable to a composite body part and its component body parts for use in an embodiment of the present invention;

Figure 15A - 15E is a graphical representation of inheritance and build-up routines;

Figure 16 is a flow chart illustrating a common law assessment method according to an embodiment of the

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present invention;

Figure 17 is a flow chart illustrating the general damages step of Figure 16;

5 Figure 18 is a flow chart illustrating the whole body pain and suffering step of Figure 17;

Figure 19 is a flow chart illustrating the whiplash severity portion of the whole body pain and suffering step of Figure 17;

10 Figure 20 is a flow chart illustrating the post traumatic stress syndrome severity step of Figure 17; and

Figure 21 is a flow chart illustrating the temporary and permanent loss of amenities steps of Figure 17.

Repeat use of reference characters in the present specification and drawings is intended to represent same or analogous features or elements of the invention.

Detailed Description of Preferred Embodiments

Reference will now be made in detail to presently preferred embodiments of the invention, one or more examples of which are illustrated in the accompanying drawings. Each example is provided by way of explanation of the invention, not limitation of the invention. In fact, it will be apparent to those skilled in the art that modifications and variations can be made in the present invention without departing from the scope or spirit thereof. For instance, features illustrated or described as part of one embodiment may be used on another embodiment to yield a still further embodiment. Thus, it is intended that the present invention covers such

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modifications and variations as come within the scope of the appended claims and their equivalents.

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I. The Model

The present invention relates to a model for assessing if and when an injured workers' compensation claimant can return to work and/or for assessing common law liability resulting from the claimant's injuries. As should be understood in the art of insurance adjustment, a workers' compensation claimant's cost to an insurance company and/or employer depends on the length of time the claimant is unable to perform his job. Thus, the model examines the claimant's injuries, and other medical conditions, with respect to the claimant's job requirements to model when such conditions will permit the claimant to meet the requirements. Common law liability depends on the severity of the claimant's injuries. Thus, in a common law scenario, the model examines the claimant's injuries, and other medical conditions, with respect to historical liability data to determine a common law liability assessment.

The model, illustrated in Fig. 1, is comprised of an engine 10, a database 12, and three front-end modules identified as "Task Wizard" 14, "Case Notebook" 16 and "Tuning Wizard" 17. The database (SQL Server Database) is an object orientated database that stores information regarding the effects of medical conditions such as injuries, pre-existing conditions, treatments, and complications on the parts of the human body. As is explained in more detail below, this information is stored in the form of profiles that relate each affected body part's dysfunction, due to the condition, to time. For example, assume that one of the stored injuries is a

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5 accordingly. By day 28, for example, the dysfunction level
may be 50%. By day 70, it may be 0%, indicating that the
vertebra has entirely healed. Each day between 0 and 70
is assigned a dysfunction level value, resulting in a
dysfunction level-v.-time profile for this particular
0 injury. Since treatments and complications also affect
body parts, profiles are provided for these conditions as
well.

Engine 10 generally uses information provided by the SQL Database to generate return-to-work plans, common law assessments and action plans that are discussed below. To produce this information, the engine applies the profiles stored in database 12 to model the human body. This model, referred to herein as the "Little Man," is a plurality of human body parts that are described by the profiles, which may be modified according to predetermined rules. Thus, each body part is described in terms of its dysfunction level at present and into the future. The default for all body parts is a zero dysfunction level. That is, the Little Man is assumed to be entirely healthy.

Certain body parts combine to form composite body parts within the Little Man. For example, each vertebra is independently described by the dysfunction level of that vertebra. The vertebrae combine, however, to form the spine, and the model generates a profile describing the spine as a whole in terms of its dysfunction level.

The Little Man includes a set of rules that describe the interdependence among the body parts. For example, an injury to one body part may have an effect on several other body parts, even though those body parts are not injured.

To analyze a particular claimant's case, the engine retrieves data from database 12 that relates to a particular claimant's injuries or other conditions. That is, once the user has indicated through the Case Notebook the conditions that apply to the claimant, the engine retrieves the profiles that correspond to those conditions and places them into the appropriate positions in the Little Man. The engine may then determine the effects of these profiles on other body parts and composite body parts to achieve a medical description of the claimant as a whole. Since the profiles describe the claimant's condition over time, and since the engine also retrieves information about the claimant's job from the database, the engine can predict when a workers' compensation claimant should be able to return to work. Furthermore, each medical condition is associated with a severity level that can be translated into one or more common law damages categories. Thus, the model can predict common law liability when actual or potential claims fall outside a workers' compensation system.

As noted above, the user may set up employer-defined occupations through Task Wizard 14. Employer-defined occupations data 18 represents information provided by one

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Certain terms used herein, for example "instance," "classes" and "slots," are standard object-oriented terms.

5 "methods." A data slot is simply a field into which data
is input to describe a unique example of the class,
referred to as an "instance." All instances in a class
have the same slots but may have different data entered
for those slots. The instances for the classes "composite
10 body part", "sight," "hearing" and "soft tissue spine" are
provided in Figure 3. "Methods" are functions executed by
the engine that require data from one or more slots in the
instances.

Classes for one preferred embodiment are listed in
15 Figures 2A and 2B. Each class includes one or more
instances. For example, there are approximately 200
instances in an exemplary "body part" class. That is, the
program divides the human body into approximately 200 body
parts. The composite body parts and their component body
20 parts are listed in the electronic appendices in the file
Body_Part.rpt. Composites are listed in column 1. The
components for each composite are listed in column 3.

As seen in Figures 2A and 2B, some classes are subclasses of other classes. A subclass is comprised of instances that are, in turn, comprised of one or more instances in the primary class. For example, the class "composite body part" is a subclass of the class "body part." The thoracic spine is an instance of the composite body part class and is comprised of 23 vertebrae and vertebrae joints that are, in turn, instances found in the body part class.

The object oriented database is constructed in accordance with the engine's data structure. For purposes of clarity, however, a detailed description of all the

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B. Setting Up A Case

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Thus, to describe a claimant's medical condition, a user simply enters all ICD9 codes that apply to that particular
5 claimant as provided by medical reports.

As discussed in more detail below, the user, for example an adjuster, may enter prognosis information received from a physician. In general, this information can be entered at any time during the case, not only at start up. Prognosis information can indicate whether the claimant is healing slowly, quickly or is not expected to recover. It can also indicate whether the claimant has a permanent dysfunction level, is fully recovered, or can perform certain activities and tasks. This information triggers the engine to modify its previous projections.

An employer may set up one or more occupations through the Task Wizard that describe the jobs performed at its places of business, or "job sites." Employer data 20 includes the employer's identification and a list of occupations performed at each job site. Each employer may have one or more job sites. Employer data 20 points to one or more occupations that are already stored in the database from data 18 and that are performed at one or more of this particular employer's job sites.

25 If the user has not independently defined the
employer's job sites and occupations through the Task
Wizard, predefined DOT occupations may be identified.

As described above, job sites point to occupations; occupations point to tasks, and tasks point to activities. Activities are generic mental or physical actions, such as reasoning, sitting and bending, that might be required in performing a task. The user is free to name and define occupations and tasks as desired. In one embodiment of the present invention, however, the activities are pre-defined

5 comprising the occupations, he then identifies which of the predefined activities make up each task. In this way, all job sites, no matter how they are otherwise described by the user, are defined by the basic building blocks (i.e. the activities) with which the program is designed to function. In one preferred embodiment of the present invention, the predefined activities are:

15	sitting	kneeling	medium lifting
	climbing ladders	squatting	light lifting
	climbing stairs	crawling	very heavy pushing
	bending	working heights	heavy pushing
	running	standing	medium pushing
20	walking	very heavy lifting	twisting
	crouching	heavy lifting	turning devices
	repetitive arm	driving	math
	repetitive leg	traverse terrain	languages
	using keyboards	grasping	reasoning
	dexterity		

25 Similarly to the pushing and lifting activities, the math,
language and reasoning activities are subdivided into
categories by ability level, for example "minimal,"
"light," "moderate," "heavy" and "very heavy."

Four of these activities (light lifting, reaching, sight and hearing) require the use of a body part of which the human body has a pair. For example, an activity may require an arm. Because there are two arms, and only one is needed, an injury to one arm does not necessarily impair the claimant's ability to perform the activity. These

Each task and each activity is identified as being either "key" or "non-key" and as being either "transferable" or "non-transferable." An occupation may have one or more key tasks and one or more transferable tasks. A task may have one or more key activities and one or more transferable activities. A key task is necessary to perform its occupation, but a non-key task is merely desirable. Thus, an injured employee may be able to return to work when able to perform all key tasks, even though he is unable to perform one or more non-key tasks. Activities are similarly described as "key" or "non-key" with respect to their tasks. Transferable tasks and activities may be applicable to occupations and tasks at the employer's jobsite(s) other than the occupations and tasks to which they are assigned through the Task Wizard. Thus, even if the model determines that an injured employee cannot return to his original occupation at a given time, an employer may be notified of any transferable tasks and activities. The employer might thereby be able to identify another job at his jobsite(s) suitable for the employee.

Referring to the flow charts in Figure 13A-13D and 16, after inputting the case information and medical details for a particular claimant, the user activates the engine through the Case Notebook (Figure 1) at 22. Since the case information includes the employer's identity, and assuming a workers' compensation case at 31, the engine retrieves all the information in the SQL database relating to that employer at 24 (Figure 13A - 13D). As noted above, assuming the user points to employer-defined data that was

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Figure 4 illustrates this example. The ICD9 code is 805.4.4. It applies to the L4 vertebrae, which is an instance of the class "body part." The intermediate code that identifies the profile for this ICD9 code is "tfrac." The intermediate codes are instances of a class "ICD9 Profile" in the SQL database. One of the slots in this class identifies whether the injury is a bony injury or a general injury. The significance of this distinction is described below. As indicated in parentheses in Figure 4, "tfrac" is a bony injury.

Returning to the example, the injury profile extends from day 0, the day the injury occurs or is diagnosed, to day 70, the day at which maximum recovery is achieved. In this case, the dysfunction level for this injury on the day it occurs is 100%. It is an injury, however, from which the claimant is expected to fully recover, as indicated by the 0% dysfunction level at day 70.

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SEX/AGE

- 25

AGE

- 40

- 10

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the age of 40, the dysfunction profile is:

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831.xxx, except 831.04 and 831.14.

curve is:

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If the claimant loses multiple teeth, however, the dysfunction curve is determined from the following table:

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If a claimant loses a number of teeth between 1 and 4, 4 and 8 or 8 and 11, the corresponding values are determined by linear interpolation.

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Applying the sex/age rules to the Figure 4 example,

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If the model determines that a workers' compensation assessment is needed, it executes the procedure described in Figure 13A - 13D. Figure 16 describes the procedure for common law assessments.

Conversely, where one or more diagnoses are provided for components, but no diagnosis is provided for their composite, it is preferable to allocate the effect of the components' conditions on the composite. This is generally referred to herein as "build-up."

Figures 15A - 15E provide a general illustration of the inheritance and build-up procedures. Referring to Figure 15A, assume that two diagnoses are applied to a composite body part. After adjustment for any applicable rules, therefore, the composite has two profiles, C1 and C2. The composite has three components, A, B and C. Components A and B have diagnoses that apply specifically to them, resulting in profiles CA1 for component A and CB1

Figures 15B and 15C illustrate the inheritance procedure. Referring to Figure 15B, profile C1 is allocated to a profile C1' that applies to each component.

Once all the composite profiles have been allocated to the component level, as shown in Figure 15D, the multiple profiles are combined to a single profile for each component, profiles CA, CB and CC. Finally, as shown in Figure 15E, the final component profiles are allocated back to the composite, resulting in a final composite profile CF.

15 In one presently preferred embodiment, the engine may inherit a composite profile down to its components by one of two methods. Under a first option, the engine considers the effect of medical conditions in one component on neighboring components based on the components' proximity to each other. These effects are generally ignored in the second option. In the present embodiment, the interrelationships among neighboring body parts under the first option are considered only for components within the same composite body part, although it should be understood that this is but one preferred embodiment and that interrelationships may be defined among body parts from different composites and among different composites. It should also be understood that the engine may consider interrelationships other than proximity.

30 The choice between the options is determined at the composite body part level, specifically by activation of either of two switches in a composite body part's database record. These switches trigger rules that determine whether the first or second option will be performed with

The first switch is the "use super gravity" slot in the composite's record. If this switch is on, and if

15 Figure 13A - 13D provides a flow chart illustrating an
exemplary embodiment of the inheritance routine. It should
be understood that the flow chart is provided only to
illustrate the model's general operation and is not
intended at a literal procedural description. It should be
20 within the skill of one of ordinary skill in this art to
create a suitable program to effect the operation as
described in Figure 13A - 13D.

Assuming option 1, the engine moves to the first profile for composite M at 36 and 38. Before allocating a composite's profile down to its components, the engine performs a test at 68 to determine whether the inheritance

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grouping values describe this relative impact in that they indicate the percentages of the dysfunction of their respective components that are to be considered in combining component profiles into a composite profile. In this case, the component value of the little finger is 10%, while the component value of the thumb is 40%. The grouping value for the group to which the little finger and thumb belong is 100%.

At 68, the engine retrieves the grouping value for each component in the composite and assumes that each component's grouping value is its dysfunction level for each day in its profile. The engine then builds the composite profile up from the assumed component profiles. If any of the calculated composite dysfunction values are less than the dysfunction values in the composite's original profile on their respective days, the engine will be unable to calculate component dysfunction values that would result in composite dysfunction values that approximate the original profile on those days. If this occurs, the engine assigns the composite's profile to each component and moves to the next composite at 94.

If the components pass the test at 68, the engine inherits the composite's profile down to the components. The goal is to assign a dysfunction level to each component each day in such a way that if the dysfunction levels of all the components on a given day are combined, they would result in the dysfunction level for the composite for that day in the composite's original profile. The engine performs this analysis one day at a time, or in groups of consecutive days if those days have the same dysfunction level. It starts at the first day or first group of days, goes through the routine described below until finding a

suitable result for that day or group, and then moves on to the next day.

The algorithm for each day or day group is iterative. The engine makes an assumption regarding what the dysfunction level should be for each component. It then uses a build-up routine to determine, based on the assumption for the components, what the composite's dysfunction level would be for that day. The engine then compares the calculated result with the composite's actual dysfunction level on that day. If the difference between the calculated dysfunction and the dysfunction in the original profile is more than a predetermined amount, the engine adjusts the guess and repeats the process until the calculated dysfunction is within the predetermined range.

The engine starts with the composite's profile. Referring to the example above, the initial profile for the thoracic spine treatment 93.51 is:

	<u>Days</u>	<u>Dysfunction Level (%)</u>
	0	50
20	112	50
	126	25
	140	10
	147	0

Since the claimant is between the ages of 50 and 59, the age rules discussed above multiply each day in the profile by 1.2:

	<u>Days</u>	<u>Dysfunction Level (%)</u>
	0	50
30	134.4	50
	151.2	25
	168	10
	176.4	0

The engine may round the day values to whole numbers.

Optionally, it may also interpolate the profile to provide dysfunction levels for each day. Whether or not interpolated, the profile is referred to below as the

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"original" profile. It is the dysfunction profile for the particular treatment identified by ICD9 code 93.51.

Since days 1 through 134 have the same dysfunction level, the engine solves for these days as a group. At 72, the first guess for the days in this group is simply the dysfunction level in the original profile for days 1 through 134 divided by the number of component body parts, 23. This results in a first component dysfunction level of 2.1739130434783 for all components. In another preferred embodiment, the first guess is the dysfunction level itself, in this case 50.

The engine next builds a composite profile from the component values, assuming the first guess. That is, it calculates what the composite's dysfunction level on days 1 through 134 would be if all the components had a dysfunction level equal to the first guess. Several parameters are involved. The first, at 42, is the component's "absolute mass", in terms of its ability to function. Since the dysfunction level for each component is 2.174%, each functions at 97.826%, or 0.97826. The equation for a given component j having a dysfunction level greater than zero is:

$$\text{Abs Mass}(j) = ((100 - \text{valuelist}(j))/100)**k\text{value},$$

where valuelist(j) is the current dysfunction level guess for component j and where kvalue is equal to 1. If at 74 the component's dysfunction level is zero, the component is not considered, and the routine moves on to the next component. In this "inheritance" procedure, however, all components have a dysfunction level - the dysfunction guess.

At 44 the next parameter, "mass difference," measures the ratio of the dysfunction value mass of component j and

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For example, the distance (T1,T2) is $\text{abs}(8-9) = 1$. In the present example, the routine determines 22 distance numbers. It should be understood that the routine could be configured to determine euclidean distance where location is defined by cartesian coordinates.

At 50, the routine begins to determine the impact of each other component k on component j. This is inversely proportional to the distance between components j and k. The "distance effect" relates to the degree to which the distance between two components affects their impact on each other:

$$\text{Distance Effect}(j,k) = (1/\text{Max}(\text{distance}(j,k) + 1), 2)**d,$$

Where $d=2$. Thus, the distance effect cannot be less than 0.25. Distance Effect(T1,T2) is $(0.5)**2=0.25$.

At 52, the impact of a component k on component j is given by the following equation:

$$\text{Impact}(j,k) = (1 - (\text{Mass Diff}(j,k) * \text{Abs Mass}(j) * \text{Distance Effect}(j,k)))**2$$

Here, using the numbers determined above, the impact of vertebra T2 on vertebra T1 is:

$$\text{Impact}(T1,T2) = (1 - (1*0.97826*.25))**2 = 0.57068$$

Since there is an impact of each component on component j, this part of the routine generates 22 impact numbers for component j - one for the impact of each of the 22 other thoracic components. At 54, the routine finds a "new mass" number for component j. This is the dysfunction level for the component j, considering the impact of the other components. The routine first sorts the impact numbers for the other components from smallest to highest and assigns each number an index k, beginning at the smallest impact

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In the present example, the amalgamated result, x(23), is the calculated dysfunction value for the composite body part for days 1 through 134 based on the first dysfunction guess. At 78, the routine compares this value with the value for days 1 through 134 in the composite's original

5 for days 1 through 134. Assuming that the final day has
not been reached at 82, the routine moves on to the next
day or group of days at 72.

or subtracting a predefined increment to the first guess and returns to 74 to repeat the procedure with the revised guess. In one embodiment, the routine increases the initial guess by 0.1 if the calculated dysfunction value is too low and decreases the initial guess by 0.1 if it is too high. If the next calculated value is still outside the range and is between the original value and the prior calculated value, the engine revises the guess by the same increment. If the next calculated value is outside the range, and the original value is between the next calculated value and the prior calculated value, the increment is halved. For example, if the calculated value after the first guess is beyond the tolerance and is too high, the routine subtracts 0.1 from the first guess to reach the second guess. If the next calculated value is still beyond the tolerance and too high, the routine again subtracts 0.1. However, if the calculated value after the second guess is beyond the tolerance but too low, the engine adds 0.05 to the second guess to reach the third guess. This process repeats until the calculated value is within the tolerance.

In another preferred embodiment, if the first guess or any subsequent guess is too low, the new guess is determined as follows:

If the first guess or any subsequent guess is too high, the new guess is determined as follows:

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new guess = 2(old guess - 50)
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In the example above, the guess that provided a result within the tolerance was 9.59579. That number, therefore, is the dysfunction level (in %) for each component due to the 50% dysfunction level resulting from the treatment to the thoracic spine on days 1 through 134. If the routine is continued for the rest of the days so that the final day is reached at 82, each component in the thoracic spine has the following profile:

	<u>Days</u>	<u>Dysfunction Level (%)</u>
20	0	9.6
	134	9.6
	151	4.31
	168	1.65
	176	0

25 If the build-up routine is performed for these 23 identical component profiles, the result will approximate the original dysfunction profile for the thoracic spine.

If there is another profile at 83 that is applicable to the composite, the routine returns to 38 to inherit that profile as well.

30 After the last profile has been allocated for
composite M, the engine determines at 99 whether the last
composite has been analyzed. If not, the engine returns to
34 and determines whether the first or second option
applies to the next composite. If the "push down from
35 here" slot is activated in the composite's database record,
if one or more of the composite's components is used in one

Assuming the same original profile (dysfunction level 50% at day 0 and dysfunction level 0% at day 176.4), days 1 - 134 have the same dysfunction level and are therefore treated as a group. At 98, the first guess for the days in this group is the dysfunction level in the original profile for days 1 - 134 divided by the number of component body parts, 23. This results in a first component dysfunction level 2.1739130434783 for all components. In another preferred embodiment, the first guess is the dysfunction level itself.

$$X(i) = X(i-1) + ((1-X(i-1)) * D(i))$$

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The routine will also detect the multiple curves for the T9-10 and T10-11 components at 86. Since profiles 62

and 66 are treatment profiles, they are combined with the inherited treatment profiles for their respective components at 90.

The engine repeats this procedure for each of the composite's components, and each component therefore has at most a single profile. At 92, the engine combines these profiles to determine a new profile for the composite. For each day, the engine executes the gravity routine described above with respect to steps 75 through 56. The result is the composite's new dysfunction level for that day. After repeating the procedure for all profile days, the engine has determined a new dysfunction profile for the composite that accounts for the profiles applied to its components.

The engine has now allocated the effects of the composite's profiles with those of its components using the first option. If the engine has not completed the final composite at 197, it moves to the next composite at 71 and determines whether the first or second option applies. If the first option applies, the engine executes the routine for the next composite as described above, beginning at 73. However, if the first option does not apply and the second option does apply, the engine then executes the second option, interpolating the profiles for each component of composite P at 111 so that the profiles have a dysfunction value for each integer day. The routine then moves to the first of the composite's profiles at 113 and determines at 115 whether multiple profiles exist for that component. If not, the routine moves to the next component through 117 to 115.

30 If a component has multiple profiles, they are
combined using the amalgamate algorithm. Moving to the
first profile day at 129 and 119, the combined profile
value X is:

For $i + 1$ to M , where M is the number of profiles for the component, where $D(i)$ is the dysfunction level in decimal form on that day for profile i , where $X(0) = 0$, and where the component's dysfunction level for that day is $X(M)$.

When the routine completes the combination of the component profiles at 117, each component has a single profile, and the engine combines these profiles to provide a composite profile. First, at 125, the routine determines a final component dysfunction value for each component for each day. Similarly to the procedure described above with respect to first option inheritance, the routine multiplies the combined dysfunction value for each day for each component by the component's component value and grouping value. That is, each component's combined profile is scaled by the applicable component and grouping values. At 127, the routine determines the composite profile by amalgamating the final component dysfunction values for each day. That is, the composite's profile dysfunction value X for each day is:

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For $i = 1$ to M , where M is the number of component profiles, where $D(i)$ is the dysfunction level in decimal form on that day for profile i , where $X(0) = 0$, and where the composite's dysfunction level for that day in the new

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C. Medical Prognoses

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5 1. Has reached MMI-has impairment/disability-
 may
 worsen in the future.

15 3. Has reached MMI-has no
 impairment/disability-
 could have problems in
 the future.

5. Has reached MMI-has no impairment/disability.

7. Is healing slowly.

9. Will heal in months.

"MMI" is an abbreviation for "maximum medical improvement."

The engine accepts only one preferred prognosis per
40 body part. If multiple prognoses are entered for the same
body part, the engine uses the one that is identified as
the "preferred" prognosis.

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Each of these prognoses requires that the user enter an impairment level. If no impairment level is entered, the engine prompts the user for a residual impairment level. If an impairment is entered, the engine executes the impairment routine described below to adjust the profile. That is, the effect of these two prognoses to a return-to-work plan is, generally, the same as if the user had simply entered an impairment rating. The prognoses are retained as separate options, however, in part because a physician's report might include such statements. Also, in one embodiment, the prognosis allows the user to establish an MMI date that is different from the prognosis date, whereas an impairment date is the prognosis date.

<u>Severity</u>	<u>Value</u>
minor, trivial, insignificant	5
mild	10
moderate	25
significant	30
considerable	40
moderately severe	50
severe	70
gross	80
profound, total	100

The engine then converts the impairment rating to a dysfunction level. "Impairment" refers to damage to the body part. "Dysfunction" refers to the inability of the body part to function as a result of the damage. As noted

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10

25

If the AMA impairment rating is assigned to any part of the spine, however, the engine compares the entered

5 Once the dysfunction level is obtained from the
entered impairment value, the engine adjusts the profile
for the applicable body part or composite body part. As
noted above, the adjustment depends on the relation between
the residual date and the prognosis date or a specified MMI
0 date.

Referring now to Figure 10, assume that the impairment level entered for this body part on April 1 corresponds to a 15% dysfunction level. The engine applies the 15% level

Referring now to Figure 10, assume that the impairment level entered for this body part on April 1 corresponds to a 15% dysfunction level. The engine applies the 15% level

5

2. Has Reached MMI-Has No Impairment

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3. Healing Satisfactorily

Assume that the prognosis period is equal to the prognosis date minus the injury start date plus 1. If the prognosis period multiplied by 1.11, or the prognosis period plus 7, is less than the number of days in the original profile, the engine assumes that the prognosis date is early enough to indicate that the prognosis agrees with the profile. In this case, the profile is not adjusted.

$$1.11 \cdot A/B$$
$$(7+A)/B,$$

where A is the prognosis period, and B is the number of
35 days in the original profile.

If the prognosis period for this prognosis is equal to
20 or greater than twice the number of days in the original
profile, and the original profile was greater than 14 days,
the engine notifies the user that this prognosis was added
well after the body part should have stabilized.
Nevertheless, the program applies the stretch factor as
25 described above.

As discussed in more detail below, the program reports to the user when the claimant will be able to perform the tasks identified for his job. If the "healing satisfactorily" prognosis is entered after the last of these "task" dates, the program issues an action item instructing the user to obtain physician confirmation that the claimant can return to work.

4. Healing Slowly, Will Heal In Weeks, Will Heal In Months and Will Heal Eventually

The last four prognoses ("healing slowly," "will heal
5 in weeks," "will heal in months" and "will heal
eventually") can also adjust a body part's profile, again
depending upon when the prognosis is entered. Except for
"healing slowly," the profile in each case ends in a 0%
dysfunction value.

```

10      If "healing slowly" is entered before the original
      residual date, the engine determines a stretch factor equal
      to:

```

$$1 + (0.33 * (A/B)) ,$$

15 where A is the prognosis period, and B is the number of
days in the original profile. The stretch factor is
applied to the days in the original profile as described
above with respect to the "healing satisfactorily"
20 prognosis. As should be apparent from the stretch factor
formula, the later the prognosis date, the greater the
stretch factor. That is, a later "healing slowly"
prognosis has a greater impact on the expected recovery
than does an earlier prognosis.

25 For example, assume that the injury start date is
January 1, the residual day is March 11 (day 70) and that
the prognosis date is March 1 (day 60). The stretch factor
is $1 + (.33 \cdot 60 / 70)$, or 1.2829. Assume that the dysfunction
level on day 25 is 97.83. Since day 25 is stretched by a
30 factor of 1.2829, the 97.83 dysfunction level occurs at day
32 in the adjusted profile.

If the prognosis is "will heal in weeks," and the prognosis date is fourteen days before the residual date, the prognosis essentially agrees with the original curve,

If the prognosis is "will heal in months," and the prognosis date is 61 days before the residual date, the prognosis essentially agrees with the profile, and no adjustment is made. If the user enters the number of months, the corresponding number of days is used instead of 61.

If the prognosis date for a "healing slowly" prognosis is after the original residual date, the engine calculates a stretch factor equal to the larger of the results of the

15 two functions below:

or

If the prognosis is "will heal in weeks," and the prognosis date plus 14 days is before or beyond the original residual date, the stretch factor is $(14 + A/B)$.

30 If the prognosis is "will heal eventually," and the
prognosis date plus 182 is before the residual date, the
stretch factor is the lesser result of the following
equations:

35 (182 + Residual Day Number)/Residual Day Number, and

5 If the prognosis date plus 182 is beyond the residual
date, the stretch factor is the lesser result of the
following equations:

10

$$2(\text{Prognosis Period})/\text{Residual Day Number}.$$

For example, assume that the number of days in the original profile is 70 and that the prognosis "healing slowly" was entered on day 79. The first stretch factor function for this prognosis is $1.33 \cdot 79 / 70 = 1.501$. The second stretch factor function is $(14 + 79) / 70 = 1.329$. The stretch factor is, therefore, 1.501.

The stretch factor is used differently for these
20 prognoses than in the prior example. If a prognosis is
applied directly to the day number, it is possible that the
task dates and activity dates could fall before the
prognosis date, particularly where the prognosis date is
significantly beyond the original residual date. Thus, for
25 these prognoses, the dysfunction level for each profile day
(D) is moved to a day equal to $D + E * (F - 1) * (((D - G) / (E - G))^{**0.25})$, where E is the original residual date, F is the
stretch factor calculated above, and G is the start date
for the latest medical condition.

30 For example, assume that the injury start date is
January 1 (day 1), that the original residual date is day
70 and that the dysfunction level on day 25 is 97.83.
Applying the above function, day 25 becomes day 52:

The result of the equation is rounded to the nearest day.
The equation is applied to each day in the original
5 profile.

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15

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If a prognosis applies to a composite body part, the manner in which it is applied depends on the relationship between the composite and its components. If there are no composite profiles, but profiles exist for one or more components, the prognosis is applied to those components. If medical conditions apply both to the composite and one or more components, if any of the components are members of conjunction records, and if the composite's profiles are inherited to the components, the prognosis is applied only to those components having their own medical conditions. If, however, none of the components have their own medical conditions, the prognosis is applied to all components. In either case, the prognosis is applied to the composite's inherited profile(s) at the component level and is, therefore, applied to the composite by the subsequent build-up routine. If none of the components are members of conjunction records, the prognosis applies only to the composite. If the composite has medical conditions and those conditions are not inherited down, the prognosis is applied directly to the composite.

Impairments are applied at 115 following the build-up procedure. Impairments applied to composites are not passed down to the composite's children unless there is only one component. In the later case, the impairment value is divided by the component's grouping value prior to being applied to the component.

Only prognoses identified as "preferred" are applied. Generally, there could be only one preferred prognosis for a body part as the program executes.

D. Determining Activity Dates

As noted above, the engine predicts when the claimant

can return to work. In general, and assuming use of the Task Wizard, the engine compares the employer's job requirements entered in the Task Wizard with the dysfunction levels established for the Little Man to
 5 estimate when those dysfunctions will allow the claimant to perform those tasks.

As discussed briefly above, body parts are related to activities in conjunction records, an example of which is provided below:

10	Activity name	bending
	body part	right hip, left hip, thoracic spine, lumbosacral spine
	frequent dysfunction	18%, 17%, 22%, 14%
15	infrequent dysfunction	40%, 40%, 45%, 50%
	frequent date	(derived by program)
	infrequent date	(derived by program)

This conjunction record identifies those body parts (right hip, left hip, thoracic spine and lumbosacral spine) that
 20 are used in the activity (bending) to which the conjunction record applies. There is a conjunction record for each activity listed in the Task Wizard.

The "frequent dysfunction" level is the maximum dysfunction level for the body part that will still allow
 25 the claimant to frequently perform the activity. This slot includes a "frequent dysfunction" value for each body part listed in the conjunction record. If the actual dysfunction level for any of the listed body parts is greater than or equal to its frequent dysfunction level,
 30 the claimant cannot frequently perform the activity. Similarly, the "infrequent dysfunction" levels are the maximum dysfunction levels that permit the claimant to perform the activity infrequently. The "frequent" and

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For example, referring to the conjunction record shown above, if the 40% dysfunction level was reached for the right hip on March 1, the 17% dysfunction level for the left hip on March 1, the 22% dysfunction level for the thoracic spine on March 5 and the 14% dysfunction level for the lumbosacral spine on March 3, the infrequent date is March 5.

Conjunction records for two-sided activities include slots for non-sided and sided body parts. For example, the spine may be a non-sided body part listed in the conjunction record for "light lifting." "Arm" might be a two-sided body part, indicating that either the right or left arm could be used. To determine the activity date for this activity, the engine builds the profiles for the non-sided body parts as described above. It then builds profiles for each of the two body parts possible for the sided body parts. In the case of "arm," it builds profiles for the right arm and the left arm. In determining activity dates for each pair of sided body parts, the

1. Lifting small/light
2. Lifting up to 20 pounds
3. Lifting up to 50 pounds
4. Lifting up to 100 pounds
5. Lifting over 100 pounds

It is possible that a physician might provide an activity prognosis for one of the pushing or lifting activities, but not the others. For example, a user may provide a "can only ever do infrequently" activity prognosis for lifting up to 50 pounds but provide no prognosis for lifting up to 100 pounds and lifting over 100 pounds, even though it is clear that those activities must have some restriction. Accordingly, the engine relates the activities within each of these groups so that an activity prognosis to one can affect others where no prognosis is otherwise entered.

The engine maintains tables, shown in Figures 11 and 12, that relate the pushing and lifting activities to the activity prognoses. Referring to Figure 11, each row represents one of the five activity prognoses, and each column represents one of the three pushing activities. Three numbers are listed in each cell in the table. The numbers range from one to five and represent the activity prognoses as numbered at the left hand side of the table.

The numbers reflect activity prognoses that may be applied to activities above and/or below an activity to which a given prognosis is assigned if no activity prognosis is assigned to those other activities. Each number corresponds to the activity prognosis for the activity in the number's position. For example, "can do now" is the first prognosis. Thus, in the cells on its row, a "1" is placed in the first position in the first cell, in the second position in the second cell and in the third position in the third cell. The other positions in

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each of the three cells indicate the prognoses that should be applied to the activities represented by the respective positions. For example, assume that the prognosis "can do now" is assigned to the "up to 100 pounds" activity. The
 5 number list for this cell is "1, 1, 2." The "1" in the second position represents the given prognosis. A "1" is in the first position in the cell, and a "2" is in the third position. Thus, if the user has applied no prognoses to the "up to 50 pounds" and to the "over 100 pounds"
 10 activities, the engine applies a "can do now" prognosis to the "up to 50 pounds" activity and "can do infrequently" prognosis to the "over 100 pound" activity.

As an additional example, assume that a "can only ever do infrequently" prognosis is applied to the "over 100
 15 pounds" activity. The applicable cell contains the numbers "1, 2, 4," where the "4" represents the "can only ever do infrequently" prognosis applied to the activity. If the user has entered no prognoses for the earlier two activities, the "1" indicates that a "can do now" prognosis
 20 is applied to the "up to 50 pounds" activity, and the "2" indicates that a "can do infrequently" prognosis is applied to the "up to 100 pounds" activity.

The same analysis applies to Figure 12 regarding the lifting activities. As an example, assume that "can do
 25 infrequently" is assigned to "lifting up to 20 pounds" and that "avoid permanently" is assigned to "lifting over 100 pounds." Referring to the first activity, the appropriate cell is "1, 2, 3, 3, 3." The "2" in the second position refers to the prognosis applied to this activity.
 30 Referring to the second activity, the appropriate cell is "1, 1, 1, 4, 5." The "5" refers to the given prognosis.

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```
5          prognosis date + 7
```

```
10      case start date + 7*(number of weeks entered with
      prognosis)
```

The "fit to resume full duties" prognosis indicates that the claimant should be able to perform all tasks as of the prognosis date. Thus, it is appropriate to change all activity dates later than the prognosis date to the prognosis date. It is not necessary to change activity dates prior to the prognosis dates since those dates already agree with the prognosis.

35 If the user enters a "fit to resume on reduced hours"
prognosis, the program again changes all activity dates

new job for the claimant.

H. Dictionary of Occupational Titles

An employer not wishing to set up a database of its own tasks and activities may rely on the Dictionary of Occupational Titles (DOT) stored in the SQL server database. The DOT includes a list of occupations, for example "construction worker." For each occupation, it lists four "attributes": "lifting," "reasoning," "language ability" and "math ability." For each attribute, in turn, the DOT lists ability ratings. For example, for the "lifting" attribute, strength ratings might be "small," "light," "medium" and "heavy."

To construct a return-to-work plan using the DOT, the user identifies the claimant's occupation through the Case Notebook. The DOT ability ratings are a subset of the activities available through the Task Wizard. Thus, each ability rating is an activity that has a corresponding conjunction record. Since each DOT occupation is tied to respective attributes and ability ratings, identification of the DOT occupation identifies the conjunction records used to determine the return-to-work plan.

The DOT occupations do not distinguish among ability ratings as being frequent or infrequent. Thus, the engine calculates only frequent dates. Otherwise, the engine determines activity dates based on conjunction records identified by DOT occupations in the manner as described above for any other occupation.

If the DOT is used, the engine reports the activity dates for each ability rating of lower magnitude than those applicable to the occupation. For example, if a job requires "up to 100 pounds" lifting ability, the model also determines the activity dates for the lesser lifting abilities. The employer may thereby determine if a

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claimant can return to work earlier on lighter duties.

The engine outputs several prompts to the user encouraging the user to take further action. Some of these are described above. For example, the engine may prompt the user to verify medical data if a prognosis disagrees significantly with the engine's predicted results. Furthermore, if a prognosis changes one or more task dates so that the claimant is out of work much longer than otherwise expected, the engine prompts the user to verify the prognosis and to check the effect of the change on the insurance company's reserves. Additionally, assume a task includes two activities, and the engine determines that the claimant will be able to return to the first activity in two weeks but must wait six weeks to return to the second activity. The engine prompts the user to request that the employer decide whether the employer would like the claimant to return to work part time in two weeks.

All such prompts are displayed to the user as part of an action plan - i.e. a list of requests to the user to take steps beyond program activities. The triggers for any action plan prompt may be tailored to a given environment. In addition to the return-to-work plan and action plan, the engine displays case information, medical details, claimant details and prognosis information to confirm the information upon which the return-to-work and action plans are based.

III. COMMON LAW

Figure 16 describes the assessment process for common law cases. In common law assessments, the focus moves, generally, from dysfunction associated with medical conditions to medical condition severity. "Severity" as used herein refers to the magnitude of a medical condition's impact on an individual. In the presently-

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described embodiment, it is a unitless magnitude on a predefined scale. The model includes transition variables that correlate severity values to monetary amounts. Thus, a user may modify the variables to reflect changes in liability trends, or to allow the model's use in a different area, without requiring modification of each severity value.

SQL server database 12 (Figure 1) includes a table that assigns a severity to each ICD9 code. The severities used for one preferred embodiment of the present invention are provided in column 8 of the Medical Body Parts.zip file in the electronic appendices. Thus, each medical condition represented by the ICD9 codes has its own severity value. The database additionally includes severities for conditions and events that may result from the ICD9 code medical conditions, for example hospital and convalescent care, future treatments and complications, loss of amenities and permanent and temporary dysfunction. The development of these severity measures is discussed in detail below.

If common law processing is selected at 31, the model determines an assessment of general damages at 200 and assesses a claimant's past and future lost income at 202 and 204, respectively. The model outputs these results in a common law assessment report at 206 and also displays an action plan, case information, medical details, claimant details and prognosis information at 208 to confirm the information upon which the assessment is based.

A. Medical Code Profiles

Upon starting a common law case, the engine again builds the Little Man. The procedure is similar to that described above with respect to workers' compensation, but there are differences. At 210, the model retrieves the

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	<u>Profile Days</u>	<u>Percent Dysfunction</u>
	0	100
	14	100
	21	60
5	28	40
	35	30
	42	20
	49	10
	56	5

10

The engine adds 0.1% to the dysfunction value at the profile's original end date (day 56) and extends the profile to the stabilization days at the original dysfunction value for the original end profile day. Thus, assuming that the stabilization days for this ICD9 code is 112, the model changes the dysfunction level at day 56 to 5.1 and adds a row to the profile listing day 112 at a 5% dysfunction.

15

If, however, the original profile ends with a 0% residual dysfunction, each day value X_1 in the original profile following the end of the initial plateau is changed to a day value X_A according to the following equation:

20

$$(X_1 - X_0) / (SD - X_0) = (X_A - X_0) / (SD - X_0),$$

25

where X_0 is the last day of the initial profile and SD is the stabilization days value. In the above example, the initial plateau is a 100% dysfunction extending from day 0 to day 14. Accordingly, day 21 is the first day value that will be adjusted. In terms of the above equation, $X_1 = 21$, $X_0 = 14$ and $SD = 112$. Thus, $X_A = ((21-14)/(56-14))(112-14)+14 = 30.33$. Rounding to the nearest whole day value, day 21 in the original profile is changed to 30. The

30

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dysfunction value, 60, does not change.

The engine repeats this process for each subsequent day value in the profile. X_0 and SD remain the same for each equation. Thus, to adjust day 28, $X_A = ((28-14) \setminus (56-14)) (112-14) + 14 = 46.66$. Rounding to the nearest whole day value, day 56 becomes day 112.

It should be understood, however, that the profile may be adjusted in any suitable manner. For example, each profile day value may be multiplied by the ratio of the assumed stabilization days to the profile's original residual period.

If the assumed stabilization days is less than the profile's original residual period, the profile is not changed.

1. Inheritance

The inheritance routine described above with respect to workers' compensation cases is used to allocate the day-to-day dysfunction values from a composite body part to its component body parts. Common law cases, however, generally do not rely on dysfunction values. Accordingly, the common law routine does not execute an inheritance procedure.

2. Apply Profile Rules

Profile rules, for example the age/sex and age rules described above, are applied to the profiles at 214 as in workers' compensation cases.

3. Combining Multiple Profiles

The engine combines multiple profiles that exist for any individual body part through the procedure described above in workers' compensation cases. In workers' compensation, the manner in which multiple profiles are

100% of the severity associated with the ICD9 code. The engine applies 60% and 25% of the severities associated with probable and possible treatments/complications, respectively.

5 The application of future treatment and complication prognoses is described in detail below. Preliminarily, however, the engine only considers an impairment or future treatment/complication prognosis if it is marked as preferred. Furthermore, in one embodiment,
10 only one impairment prognosis, and only one future treatment/complication prognosis, may be marked as preferred. The user may, however, create a master prognosis that includes multiple other prognoses that are deemed necessary. Thus, by marking the master prognosis as
15 preferred, the user allows the engine to consider multiple prognoses.

1. Recovery Prognoses

 In contrast to workers' compensation cases, common law
20 cases consider multiple recovery prognoses. Common law cases are more likely than workers' compensation cases to involve multiple injuries to multiple body parts or systems. It is, accordingly, more appropriate to consider multiple recovery prognoses.

25 The engine applies recovery prognoses based on rules that defer to certain medical practitioners and to more time-specific prognoses. Medical practitioners are classified into two general categories: physicians (specialists and general practitioners) and
30 physiotherapists (chiropractors, physical therapists and osteopaths). For a given body part, the engine accepts those recovery prognoses, whether or not marked as preferred, that are assigned by a physician and that have a prognosis date greater than the latest medical occurrence

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5 a. "Has Reached MMI" Recovery
Prognoses

b. "Healing Satisfactorily" Recovery
Prognosis

$$1.11 * A/B$$
$$(7+A)/B,$$

c. "Will Heal in Weeks" Recovery Prognosis

30 This algorithm is unchanged from workers' compensation. If the prognosis date plus 14 days is before or beyond the original residual date, the stretch factor is $(14+A/B)$, where A is the prognosis period and B is the residual period. Assuming a March 20 prognosis date in the
35 above example, the stretch factor is 0.93.

1.33 (A/B) and
(14+A)/B,

If there are multiple "healing slowly" prognoses in a common law case, this algorithm overly stretches the residual date. Accordingly, it is applied only if the prognosis is the last "healing slowly" prognosis. For earlier "healing slowly" prognoses, the model determines if (prognosis date/residual date) is greater than two. If (1) this value is greater than two, the residual date is greater than the qualifying time (discussed below) and the prognosis has not yet been processed or (2) if the profile has a residual date greater than zero and the prognosis date is less than the residual date, the profile is not changed. Otherwise, the engine shrinks or stretches the curve by a factor equal to the maximum of:

where A is the prognosis period and B is the residual period.

C. Determine General Damages

As indicated above, general damages assessments are based on severities and stabilization days for ICD9 code medical conditions and subsequent conditions and events resulting from such medical conditions. For each ICD9 code, the database assigns a severity between 0 and 300,000 and a stabilization day value. For example, a dislocated

elbow has a severity of 8,000 with an assumed stabilization period of 84 days. That is, a claimant's dislocated elbow is expected to reach maximum medical improvement in 84 days with a pain and suffering severity of 8,000. In the presently described embodiment, the 0 to 300,000 scale is used for computational efficiency. As discussed in detail below, severities are converted to a 0 to 100 scale in converting to a monetary value.

- 10 1. Determine Whole Body Pain and Suffering
 - a. Find Pain and Suffering Severity
 for Each Body Part

Figure 17 illustrates general damages step 200.

Following application of prognoses at step 216 (Figure 16), the model determines whole body pain and suffering severity at 218. This procedure is more specifically illustrated in Figure 18. At this point, the engine has determined a single dysfunction profile, adjusted for stabilization days and to account for any prognoses that may apply, for each body part to which a medical condition (i.e. profile) applies. The residual period of the resulting profile is now considered the body part's "actual stabilization days."

The profile combination did not, however, combine severity values. Thus, at 220, a body part with multiple medical conditions still has multiple severity values, even though it now has a single profile. The first step in determining the severity for the whole body is, therefore, to determine at 222 a total severity for each body part. This procedure employs the gravity algorithm discussed above with respect to workers' compensation cases.

As an example, assume that a claimant's left elbow has suffered a dislocation injury, a villonodular synovitis complication and a reduction treatment. The injury dates, stabilization days and severities for these medical

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Left Elbow Dislocation Injury
(832.01.L)

Injury Date: 1/1/98
Stabilization Days: 84
Severity: 8000

Left Elbow Villonodular Synovitis
Complication (719.22.bL)
Complication Date: 5/15/98
Stabilization Days: 21
Severity: 2000

Left Elbow Reduction Treatment
(79.82.L)
Treatment Date: 1/1/98
Stabilization Days: 98
Severity: 2500

As discussed above with respect to workers' compensation, the gravity algorithm combines a given aspect, such as dysfunction or severity, of coexisting conditions for a given entity, or for multiple entities, such as body parts, composite body parts or the whole body, taking into consideration the effect of the conditions on each other. The determinative relationship among the aspects being combined may vary with the aspect but is reflected in the gravity algorithm by the location and distance values. For example, workers' compensation cases focus on body part dysfunction resulting from medical conditions. The effect of one dysfunction on another depends on the spatial relationship of the dysfunctions, i.e. how far apart they are from each other in the Little Man. Thus, the determinative relationship among medical conditions in

5

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stabilization days, in this case the treatment.

Accordingly, included stabilization time is 98 days. Using the above equation, the location for the injury is 0, and the location for the complication is 6.837.

5 The location for the reduction treatment, and for all treatments, is 1. As described in detail below, treatments are combined separately from complications and injuries. That is, the engine applies gravity for all complications and injuries as a group, then applies gravity for all
10 treatments. The result of the complication/injury combination is then combined with the treatment result.

The gravity algorithm employs the following variables.

Local Absolute Mass(j) = $((100 - \text{valuelist}(j))/100)^k$, where
15 valuelist(j) is the severity value, divided by 3,000, for medical condition j.

20 Mass difference(j,k) = $(\min(\text{valuelist}(j), \text{valuelist}(k)) / \max(\text{valuelist}(j), \text{valuelist}(k)))^g$,

where valuelist(j) is the severity, divided by 3,000, of
25 medical condition j, valuelist(k) is the severity, divided by 3,000, of medical condition k, and g is equal to 1. The local absolute mass variable applies to each medical condition individually, whereas the mass difference variable applies to medical condition pairs. Thus,
30 assuming there are four medical conditions, there are four local absolute mass values and six mass difference values.

The engine then determines the "distance" between two severity masses as the difference in their locations. The routine determines the distance between severity j and each
35 other severity k according to the equation:

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where location(j) is the location of medical condition j,
5 and location(k) is the location of medical condition k.

Distance Effect(j,k) = $(1/\text{Max}(\text{Distance}(j,k) + 5), 2)^d$,

15 where d is 2. Since the smallest possible value for distance is 0, this equation will always be $(1/\text{distance}(j,k) + 5)^d$, and therefore cannot be less than 0.04.

$$\text{Impact (j,k)} = (1 - (\text{Mass Diff(j,k)} * \text{Loc Abs Mass(j)} * \text{Distance Effect(j,k)}))^2.$$

30 The routine finds a "new mass" number for medical condition j. This is the severity for medical condition j, considering the impact of the other medical conditions. The routine first sorts the impact numbers for the other medical conditions from smallest to highest and assigns

each number an index k , beginning at the smallest impact number, sequentially from 1 to M , where k is an integer and where M is the number of other medical conditions. To determine "new mass" for medical condition j , the routine

5 executes the following function:

$$\text{Loc New Mass}(j,k) = \text{Loc New Mass}(j,k-1) * (1 - ((1 - \text{Impact}(j,k))/k)),$$

10 for $k = 1$ to M , where $\text{Loc New Mass}(j,0)$ is $\text{valuelist}(j)$, and where $\text{New Mass}(j) = \text{Loc New Mass}(j,M)$.

The routine determines a Loc New Mass value for each medical condition. It then manipulates this value according to the following equation:

15
$$\text{New Mass}(j) = \text{Loc New Mass}(j) * 100 / \text{Bound},$$

where Bound is a value determined by the following equation:

20
$$\text{Bound} = 2 \sum_{j=1}^M \text{valuelist}(j),$$

where $\text{valuelist}(j)$ is the severity value, divided by 3,000, for medical condition j and where M is the total number of medical conditions. As indicated above, injuries and

25 complications are combined separately from treatments. Accordingly, a Bound value is determined for the injury and complication conditions, without consideration of treatments. The engine also determines a Bound value for treatments.

30 Following the manipulation of the Loc New Mass values, the routine has a New Mass value for each medical condition, including injuries, complications and treatments. The routine now amalgamates the New Mass values for (1) injuries and complications and (2)

35 treatments.

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The amalgamate function is:

$$X(n) = X(n-1) + ((1-x(n-1)) \text{ New Mass}(n)),$$

```

5   for n = 1 to M, where M is the number of New Mass values
      being combined, New Mass(1) is the first of those values
      and X(0) = 0. The result, X(M), is the combined severity
      value. New Mass values are converted to a decimal
      format prior to amalgamation. The routine then modifies
10  the amalgamate results to back out the bound factor and
      the decimal conversion and to convert the severity values
      back to a 0 to 300,000 scale:

```

$$Z(I/C) = (X(I/C) - \text{Bound}(I/C)/100) 3000$$

15 and

$$Z(T) = (X(T) \text{ Bound}(T) / 100) 3000,$$

where $X(I/C)$ and $X(T)$ are the amalgamate results for the injuries/complications and for the treatments, and
20 $Bound(I/C)$ and $Bound(T)$ are the bound values for the injuries/complications and for the treatments, respectively. The results, $Z(I/C)$ and $Z(T)$, are summed to arrive at a single severity value, on a 0 to 300,000 scale, for the body part.

25 Referring to the left elbow injury, complication and
treatment described above, the determination of the left
elbow's total body part severity is set forth below. As
discussed above, the injury/complication calculation
parallels the treatment calculation. In this example,
30 since there is only one treatment, the treatment severity
is brought directly down to the final treatment severity,
 $Z(T)$. The final injury/complication severity, $Z(I\backslash C)$, is
8,860. Thus, the total body part severity is 11,360.

5	Loc	Abs	Mass (I)	=	(100-2.667)/100	=	0.973
	Loc	Abs	Mass (C)	=	(100-0.667)/100	=	0.993
	Loc	Abs	Mass (T)	=	(100-0.833)/100	=	0.992

$$\text{Mass Diff}(T, _) = N/A$$

Distance Effect(I,C) = $1/\max(6.84 + 5, 2) = 0.084$
Distance Effect(T,_) = N/A

Loc New Mass (I) = $2.667(1 - ((1-0.960)/1)) = 2.560$
 Loc New Mass (C) = $0.667(1 - ((1-0.959)/1)) = 0.640$
 Loc New Mass (T) = N/A

```

30      New Mass (I) = 2.560 * 100/6.667 = 38.398
      New Mass(C) = 0.640 * 100/6.667 = 9.585
      New Mass(T) = N/A

```


15 The complication is diagnosed on May 15, 134 days
after the case start date of January 1. Since its
stabilization days is 21, the length of the case is 155
days. To determine the body part's severity adjustment,
the routine determines the severities for 119 and 155 day
20 periods on a linear curve extending 1100 days between
severities of 0 and 11,360 (the total body part severity
determined above) and finds the difference between those
severities. If the total body part severity is greater
than 14,000, the curve is capped at 14,000. Solving the
25 following equations for X_1 and X_2 :

$$(1100-0)/11,360-0) = (119-0)/(X_2-0),$$

Finally, the above example did not include prognoses.

10

- 15

20

25

30

35 severities for each of these medical conditions is set

Left arm (composite)
Nerve Decompression Treatment (04.49.Bc1)
Start Date: 1/1/98
Stabilization Days: 112
Severity: 1000

Left Elbow (component)
Dislocation Injury (832.01.L)
10 Start Date: 1/1/98
 Stabilization Days: 84
 Severity: 8000
Villonodular Synovitis Complication (719.22.bl)
 Start Date: 5/15/98
15 Stabilization Days: 21
 Severity: 2000
Reduction Treatment (79.82L)
 Start Date: 1/1/98
 Stabilization Days: 98
20 Severity: 2500

Left Forearm (component)
Ulna Nerve Compression Injury (955.2.Lcl)
Start Date 1/1/98
Stabilization Days: 182
Severity: 12,500

Assume also that there is a "healing slowly" prognosis applied to the left arm on May 1, 1998. Assuming that the left elbow and left forearm are the only left arm components having medical conditions, the prognosis is passed only to them. The left elbow, however, has a treatment with an effective date beyond the prognosis date. Thus, the prognosis is only passed to the forearm.

The left elbow medical conditions are the same as given in the body part combination example above. Thus, as explained in the example, the total left elbow severity is 11,734. There is only one medical condition applicable to the left forearm, with a severity of 12,500. Since it is the only medical condition, the total severity for this body part remains 12,500. The severity is adjusted, however, because of the "healing slowly" prognosis.

The adjustment is based on the residual date adjustment made at 216. Since the prognosis date is before the medical condition's residual date, the residual date stretch factor is $1 + 0.33(A/B)$, where A is the prognosis period and B is the original residual period. The prognosis effective date is May 1, 120 days after the case start date, January 1. The residual date is 182 days after the case start date. Accordingly, the stretch factor is $1 + 0.33(120/182) = 1.218$. Thus, the new residual date, adjusted at 216 for the prognosis, is $182 * 1.218 = 222$. The model determines the prognosis severity adjustment according to the following severity curve:

The assumed residual date was day 182, while the actual residual date was day 222. The severity adjustment is the difference between the severities calculated on the curve for these days. Interpolating for days 222 and 182, the severity values are 2,523 and 2,068, respectively. The difference, 455, is the severity adjustment added to the total forearm severity, 12,500, resulting in a final

following linear severity adjustment curve:

	<u>Days</u>	<u>Severity</u>
	0	0
5	1,100	1,000

the severity on day 222 is 202, and the severity on day 112 is 102. Accordingly, the severity adjustment is 100, and the final severity for the left arm composite prior to consideration of the component severities is 1,100.

To combine the severities for the composite and its components, the model again uses a variation of the gravity routine discussed above. In combining the severities for a single body part, the spatial location of the severities was the same, and the determinative factor for the combination was the time duration of the severities. As a result of the body part combinations, each body part has a severity value on a scale that is comparable to that of each other body part with respect to time. In combining the severities from one body part to another, the determinative factor is spatial distance.

The gravity algorithm applies to all composite/component severity combinations, and the model therefore considers the three-dimensional position of the body parts with respect to each other. Accordingly, in determining the location of each body part, the model refers to its coordinates as described with respect to a three-dimensional Cartesian space centered at the base of the spine. That is, the Little Man is mapped so that each body part has X, Y and Z coordinates in a space defined such that the 0,0,0 position is at the base of the spine. The mapping describes the body in a sitting position with its parallel legs extending straight from the torso. The arms are also parallel and extend straight forward from the

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torso, parallel to the legs. The palms of the hands and the soles of the feet face forward, so that the fingers and toes point upward. The coordinates of each body part are listed in columns 8, 9 and 10 of the file Body_Part.rpt of the electronic appendices.

The coordinates of the left arm and its five components, and the coordinates for two of the left arm components that are themselves composites, are set forth below.

10		<u>Arm Composite</u>		
		<u>X</u>	<u>Y</u>	<u>Z</u>
	left arm	3	9	-3
	--left shoulder	1	7	-3
	--left upper arm	2	7	-3
15	--left elbow	3	7	-3
	--left forearm	4	7	-3
	--left wrist and hand	5.5	7	-3
		<u>Wrist and Hand Composite</u>		
20		<u>X</u>	<u>Y</u>	<u>Z</u>
	left wrist and hand	5.5	7	-3
	--left wrist	5	7	-3
	--left hand	6	7	-3
25		<u>Hand Composite</u>		
		<u>X</u>	<u>Y</u>	<u>Z</u>
	left hand	6	7	-3
	--left palmer hand	7	7	-4
	--left dorsal hand	6	8	-4
30	--left thumb	6	9	-2
	--left index	6	9	-3
	--left middle	6	9	-4
	--left ring	6	9	-5
	--left little	6	9	-6

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There are only two components in the wrist and hand composite, and the appropriate position for the composite is midway between the two.

The gravity algorithm that combines component severities with composite severities is similar to the gravity algorithms described above, primarily except for the distance calculation, which relies on Euclidean distance rather than one-dimensional linear distance or the difference between time-based location values. This "three-dimensional" gravity routine is described by the equations below:

$$\text{Loc Abs Mass } (j) = ((100 - \text{valuelist}(j))/100)^k,$$

where $\text{valuelist}(j)$ is the severity value (divided by 3,000) for component j and where $k = 1$.

5

$$\text{Mass Diff}(j,k) = (\min(\text{valuelist}(j), \text{valuelist}(h)) / \max(\text{valuelist}(j), \text{valuelist}(h)))^g,$$

where $g = 1$.

10

$$\text{Distance}(j,k) = (X(j) - X(k))^2 + (Y(j) - Y(k))^2 + (Z(j) - Z(k))^2,$$

where $X(n)$, $Y(n)$ and $Z(n)$ are the X , Y and Z

15

coordinates, respectively, of body part n .

$$\text{Distance Effect}(j,k) = (1/\max(\text{Distance}(j,k) + 5), 2)^d,$$

where $d = 1$.

20

$$\text{Impact}(j,k) = (1 - (\text{Mass Diff}(j,k) * \text{Loc Abs Mass}(j) * \text{Distance Effect}(j,k)))^2.$$

25

$$\text{Loc New Mass}(j,k) = \text{Loc New Mass}(j,k-1) * (1 - ((1 - \text{Impact}(j,k))/k),$$

for $k = 1$ to M for Loc New Mass in ascending order, where M is the number of component/composite body parts being combined, $\text{Loc New Mass}(j,0) = \text{valuelist}(j)$, and Loc New

30 $\text{Mass}(j) = \text{Loc New Mass}(j,M)$.

$$\text{New Mass}(j) = \text{Loc New Mass}(j) * 100/\text{Bound},$$

where $\text{Bound} = 2 \sum_{j=1}^M \text{valuelist}(j)$ and M is the number of

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$$X(n) = X(n-1) + ((1 - X(n-1)) * \text{New Mass}(n)),$$
$$\text{Total Severity} = X(M) * (\text{Bound}/100) * 3,000_1$$

Returning to the example above, the left arm composite has a total severity of 1,100, while the left elbow and left forearm components have severities of 11,734 and 12,955, respectively. Thus, the coordinates and severities for the arm and its components are as follows:

25

The arm severity is 0.0333, instead of 0.3667, because the treatment severity of 1,000 is not considered in this portion of the routine. The treatment at the composite body part level is not specific to the composite. The composite body part is not injured, and the treatment is actually against one of its components. Where multiple components are injured, it is unclear to which component the treatment should apply. Without knowing the proper distance

5 Thus, the arm severity in the table above is
100/3,000. The treatment severity is included at a
later step.

Executing the gravity algorithm for the left arm (A),
left elbow (E) and left forearm (F),

Valuelist(A) = 0.0333

$$\text{Valuelist}(F) = 4.318$$

15

$$\text{Abs Mass (F)} = (100 - 4.318)/100 = 0.957$$

20

$$\text{Mass Diff(A,F)} = \min(3.911, 4.318) / \max(3.911, 4.318) = 0.9057$$

25

$$\text{Distance (A, F)} = (3 - 4)^2 + (9 - 7)^2 + (-3 + 3)^2 = 5$$
$$\text{Distance (E,F)} = (3 - 4)^2 + (7 - 7)^2 + (-3 + 3)^2 = 1$$

30

$$\text{Distance Effect (A,F)} = 1/\max(5 + 5), 2 = 0.100$$

Distance Effect (E,F) = $1/\max(1 + 5), 2 = 0.167$

35

$$\text{Impact}(A,E) = (1 - 8.514 \times 10^{-3} * 0.9997 * 0.111)^2 = 0.9981$$
$$\text{Impact}(E,A) = (1 - 8.514 \times 10^{-3} * 0.961 * 0.111)^2 = 0.9982$$
$$\text{Impact (A,F)} = (1 - 7.711 \times 10^{-3} * 0.9997 * 0.100)^2 = 0.9985$$
$$\text{Impact}(F,A) = (1 - 7.711 \times 10^{-3} * 0.957 * 0.100)^2 = 0.9985$$
$$\text{Impact}(E,F) = (1 - 0.9057 * 0.961 *$$

```

5      Loc New Mass (A) = 0.0333(1 - ((1 - 0.9981)/1)
      (1 - ((1 - 0.9985)/2) = 0.03321

```

10

15

$$\text{New Mass (F)} = 3.1565 * 100/16.52 = 19.11$$

25

$$\text{Total Severity} = 0.3323(100)(16.52/100)(3,000) = 16,469$$

As noted above, the engine rolls severities up to composites according to the composite's hierarchy. That is, if a first composite is itself a component of a second composite, the engine determines the severity for the first composite before the second. For example, referring to the arm, wrist and hand, and hand composites illustrated above, assume that in addition to the injuries, treatments and complications provided in the example, the left thumb and left index finger had also been injured. The model, at 224, rolls the component severities into the composite severity for the left hand, calculating a total severity for the left hand. The model then revises the coordinates

for the left hand at 228 as described below. These coordinates replace the 6, 7 and -3 coordinates for the left hand in the left wrist and hand composite. The model then rolls the left wrist and left hand severities into the left wrist and hand composite, using the coordinates and severity for the left hand determined in the prior step. At 228, the model determines new coordinates for the left wrist and hand composite that replace the 5.5, 7 and -3 coordinates for the left wrist and hand as a component in the arm composite. Returning to step 224, the model determines the total severity for the arm composite, using the previously calculated left wrist and hand severity and the revised left wrist and hand coordinates. This process continues until severities have been determined for all composites, except for the Whole Body composite.

c. Recalculate Composite Coordinates

Referring now to step 228 and the example above regarding the injuries, treatments and complications to the left arm, left elbow and left forearm, the engine recalculates the arm's coordinates based on a combination of individual body part vectors, where the vectors are defined by the body part coordinates and severities. Continuing the example, the body parts within the arm composite have the following coordinates and severities:

<u>Body Part</u>	<u>X</u>	<u>Y</u>	<u>Z</u>	<u>Severity/3.000</u>
left arm	3	9	-3	0.0333
--left shoulder	1	7	-3	0
--left upper arm	2	7	-3	0
--left elbow	3	7	-3	3.911
--left forearm	4	7	-3	4.318
--left wrist and hand	5.5	7	-3	<u>0</u>
				8.262

Again, the 1,000 severity for the left arm treatment is not considered since it is not properly allocated to the component to which it applies.

Determining the percentage of the total severity contributed by each body part, the arm, left elbow and left forearm contribute, in decimal format, 0.004, 0.523 and 0.473, respectively, of the whole. Each body part's contribution to the total severity is projected onto its position vector as defined by its coordinates. That is, the X, Y and Z components for each body part are multiplied by the body part's severity contribution, resulting in the weighted body part coordinates below:

				Severity
15	<u>Body Part</u>	<u>X</u>	<u>Y</u>	<u>Z Contribution</u>
	left arm	0.012	0.036	-0.012 0.004
	-left shoulder	0	0	0 0
	-left upper arm	0	0	0 0
	-left elbow	1.419	3.311	-1.419 0.473
20	-left forearm	2.092	3.661	-1.569 0.523
	-left wrist and hand	0	0	0 0

The weighted coordinates can be considered vectors representing the contribution of each body part to the total severity. The sum of these vectors produces the revised coordinates for the arm, as set forth below.

$$\begin{aligned} X: & 0.012 + 1.419 + 2.092 = 3.523 \\ Y: & 0.036 + 3.311 + 3.661 = 7.008 \\ Z: & -0.012 - 1.419 - 1.569 = -3.000 \end{aligned}$$

Thus, in subsequent combinations in which the arm is a component, the arm coordinates are 3.523, 7.008 and -3.000.

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sacral area are components of the soft tissue spine composite. The spine, a separate composite, has the same components. Thus, ICD9 codes that relate to demonstrable injuries may be applied to the spine body parts, while codes relating to whiplash injuries are applied to the soft tissue spine body parts. Unlike the profiles for demonstrable injuries, the engine does not stretch the profile residual dates for whiplash profiles for differences between the original residual date and assumed stabilization days.

Prognoses, however, apply to whiplash profiles as for any other profile. The whiplash profiles and their severities are combined up to the soft tissue spine composite body part severities in the same manner as discussed above with respect to steps 224 and 228, except for the distance calculation. Prior to combining the severities for the body parts, however, the engine derives the whiplash severities according to the procedure discussed below.

Whiplash is a common complaint among claimants involved in automobile accidents. Unfortunately, such injuries are difficult to diagnose, and the engine therefore adjusts whiplash severities according to the external factors that tend to indicate the existence or absence of the injury. These factors include the existence of other injuries, the length of treatment, the type of treating practitioner, the number of visits to treating practitioners and delay in seeking treatment.

Figure 19 illustrates the whiplash procedure. At 234, the engine obtains the whiplash profiles and adjusts the profiles for prognoses and profile adjustment rules. It then determines the treatment time, an indicator of the period in which the claimant

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5

```
Stab. Date = Prognosis Date + # months -
              start date + 1.
```

```
Stab. Date = Max(7 + Prognosis Period, 1.11 *
                  Prognosis Period)
```

```
15      Stab. Date = Max(14 + Prognosis Period, 1.33 *
                        Prognosis Period)
```

Stab. Date = 14 + Prognosis Period

"Will Heal Eventually"

```
Stab. Date = Min(182 + Prognosis Period, 2 *
                  Prognosis Period)
```

25

Stab. Date = MMI Date - Case Start Date + 1,

30

Once the stabilization dates have been determined, the routine ignores those prognoses having a stabilization date before the latest treatment date. The routine assumes that the later treatment accounts

A second weighting reflects relative confidence among medical practitioners as defined by the user. A weight is defined for each type of practitioner. For example, a user may have a 30% confidence level in a prognosis provided by a chiropractor as compared to that provided by a treating specialist. Accordingly, assuming that the treating specialist receives the highest confidence level, the treating specialist factor is 1, and the chiropractor's weighting factor is 0.3.

For example, assume that a treating specialist provided a "will heal eventually" prognosis on March 15 and that a chiropractor provided a "will heal in 30 months" prognosis on April 28. The predicted stabilization period for the treating specialist's prognosis is $\text{Min}(182 + 74, 2(74)) = \text{Min}(256, 148) = 148$. The predicted stabilization period for the chiropractor's prognosis is $((\text{April } 28 - \text{January } 1) +$

Assume also the physiotherapist treatments described in the example above. The latest treatment has an effective date of April 9, but the latest treatment date was changed to 118 due to a final non-MMI recovery prognosis. Since January 1 + 148 and January 1 + 208 are both beyond April 28, 118 days after the case start date, both prognoses are considered in the weighted combination.

Assuming that the chiropractor's practitioner weighting factor is 0.3, the final weighting for the
20 chiropractor prognosis is $1(0.3) = 0.3$. If the practitioner weighting for treating specialists is 1, the final weighting for the treating specialist's prognosis is $1(0.6271) = 0.6271$. The treatment period is determined as follows:

$$\begin{aligned} & (0.6271 * 148 + 0.30 * 208) / (0.6271 + 0.3) \\ & = (92.81 + 62.4) / 0.9271 \\ & = 167.41 \end{aligned}$$

Referring again to Figure 19, the model

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Using a similar interpolation, the assumed specialist visits is 0, the assumed general practitioner visits

	<u>Specialist Visits</u>	<u>Severity</u>
	0	0
	1	500
5	2	1,000
	3	1,500
	4	2,000
	5	2,500
	10	4,000
10	999	10,000

	<u>GP Visits</u>	<u>Severity</u>
	0	0
	3	300
15	4	400
	7	700
	9	900
	12	1,200
	20	2,000
20	999	5,000

	<u>Phys. Visits</u>	<u>Severity</u>
	0	0
25	5	350
	8	500
	15	750
	20	1,000
	25	1,200
30	30	1,300
	50	1,500
	999	5,000

Turning first to the specialist adjustment, the

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for lack of treatment. The default value for this parameter is 1.

Regarding general practitioner visits, the difference between assumed visits and actual visits is
 5 -6, which is beyond the threshold. Using a linear interpolation for the absolute value, 6, the GP contribution is 18.33.

Regarding physiotherapist visits, the difference between actual and assumed visits is -15, which is
 10 equal to or less than the threshold. The absolute value of the difference is 15. Referring to the table, the physiotherapist contribution corresponding to 15 visits is 20.

The engine applies a gravity algorithm to combine
 15 the contribution for specialists (S), general practitioners (GP) and physiotherapists (P) as set forth below. The "distance" value between 2 entities is the absolute value of the difference between the locations for those entities.

20

valuelist(S) = 10	location(S) = 1
valuelist(GP) = 18.33	location(GP) = 1
valuelist(P) = 20	location (P) = 1

25

k,g = 1
d = 2

Loc Abs Mass(S) = $(100 - 10)/100 = 0.90$
 Loc Abs Mass(GP) = $(100 - 18.33)/100 = 0.8167$
 30 Loc Abs Mass(P) = $(100 - 20)/100 = 0.80$

Mass Diff(S,GP) = $\min(10, 18.33)/\max(10, 18.33) =$
 0.5456

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and convalescent care. Convalescent care is considered to be less traumatic than hospital stays. Thus convalescent care severities calculated from the table are multiplied by a factor of 0.7. Furthermore, the table covers up to a 10 year period, and the engine will calculate a severity based on an actual number of days, up to 10 years. The user has the option, however, to enter "permanent" for either hospital stay or convalescent care. For "permanent" hospital stays or convalescent care periods, the engine calculates the severity from the table based on 90 days. The engine assumes that other methods of compensating the claimant, for example loss of amenities as discussed below, will be used to compensate the claimant for the extended hospital stay or convalescent care period.

As an example, assume that the claimant entered the hospital on January 1 and was discharged on January 14. The overall period, 14 days, is reduced by 1 to account for a 1 day assumption for admittance and discharge time, leaving a hospital stay period of 13 days. Using a linear interpolation, the severity assigned by the table above for 13 days is 1,600.

In one embodiment, the model does not allow overlapping hospital and convalescent periods. Thus, continuing the example, assume that on January 15, the claimant begins receiving permanent convalescent care. By linear interpolation, the severity for 90 days assigned by the above table is 5,895.52. Applying the 70% multiplier, the convalescent severity is 4,126.87. Adding the 1,600 hospital severity, the total hospital and convalescent severity is 5,726.87.

In the above-described embodiment, the engine does not accept overlapping hospital stays. Thus, if

assumed treatment period. Like whiplash, PTSD is a non-demonstrable injury.

Its ICD9 code (308.3.a) is directed to the PTSD body part, which is a component of the composite body part

5 "psyche." Although the PTSD body part does have a dysfunction-v-time profile, it is not included as a body part in the conjunction records or the loss of amenity function described below and, therefore, does not affect workers' compensation or loss of amenity
10 calculations. It should be understood, however, that the model could be set up to include such considerations.

The user enters the PTSD ICD9 code with other medical details (Figure 1) applicable for the
15 claimant. Upon entering the PTSD code, a sub-panel is available to the user to enter the symptoms that may be exhibited by the claimant to indicate the PTSD condition. These include gastrointestinal disorders, flashbacks, enuresis, nightmares, insomnia, heart
20 palpitations, excessive sweating, panic attacks, fear of travel, reactive depression, aggressive outbursts, social withdrawal, general fatigue and psychogenic amnesia.

To determine a PTSD severity in the present
25 embodiment, the user must enter evidence that the claimant has received treatment for the disorder. As with whiplash, treatment may be indicated by treatment ICD9 codes or by recovery prognoses. The prognoses are, generally, the same as described above.
30 Treatment ICD9 codes applicable to PTSD are as follows:

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Had other recovery prognoses been considered, their predicted stabilization periods would have been

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If recovery prognoses have been defined, but no treatment codes have been entered, the engine determines the assumed severity by column 2.

25 If the claimant has had depression for more than
12 months without seeking psychiatric drug therapy or
psychotherapy treatments (ICD9 codes 94.25 and 94.31),
the engine determines severity from column 3. If
treatment codes have been entered and the claimant
does not have depression, the engine determines
30 assumed severity from column 3.

Recalling the example, treatment months is 7.87. The claimant has depression. The treatment months is

5 column 1 to the assumed severities in column 4, the
assumed severity is 3,467.74.

10 Applying a linear interpolation for 7.87 months to the
assumed treatment time in column 5, the assumed
treatment time, in weeks, is 7.87.

15 the severity that would have been assigned if no
treatment codes had been provided in the case. It
then determines the severity that would have been
assigned if the actual treatment time had equaled the
assumed treatment time. This creates a linear scale
20 used to determine the final reduction value.

25 case, the assumed severity would have been determined
from column 2 rather than column 3. Accordingly, in
the first step, the engine employs a linear
interpolation for the treatment months, 7.87, against
the severities in column 2 to derive a "no treatment"
30 severity of 1,155.83.

In step 2, the engine assumes that the actual treatment equals the assumed treatment time (7.87

In step 3, the engine determines a severity for
5 the actual treatment time between these extremes. In
this example, the interpolation is between the "no
treatment" and "equal treatment" treatment weeks and
severities:

15 Applying a linear interpolation for three weeks
against the severity column, the "actual treatment"
severity is 1,595.66. The severity adjustment is the
"assumed treatment" severity, 2,311.67, minus the
20 "actual treatment" severity, 1,595.66, or 716.01.
Subtracting this from the calculated assumed severity,
3,476.74, the PTSD severity is 2,760.73.

```

min(min(A,B),C) - assumed treatment time, where
30  A = 26,
    B = Treatment Time, and
    C = Treatment Months * (30/7)

```

Continuing the example, minimum treatment time is:

$$\min(\min(26, 13), 7.87(30/7)) - 7.87 = 5.13$$

5 Next, the engine determines the treatment limit based on column 6 of the table above. Applying a linear interpolation for 7.87 months against column 6, the treatment limit is 2,000.

The engine then determines the result of the
10 following equation:

Min(26, treatment months (30/7)) -
assumed treatment time

15 In this example, treatment months is 7.87, and the
assumed treatment time is 7.87 weeks. Thus, the
result of the above equation is 18.13.

The severity adjustment is determined by finding the severity that corresponds to the result of the first step, 5.13, on a scale defined by the results of the second and third steps. That is, assuming that 5.13 weeks falls between 0 weeks and 18.13 weeks, and assuming that the severity for 0 weeks is 0 and that the severity for 18.13 weeks is 2,000, the severity value for 5.13 weeks is, by linear interpolation, 565.91. Adding to the calculated assumed severity, 3,467.74, the PTSD severity is 4,033.58.

5. Combine Severities

30 Referring again to Figure 17, the engine combines the whole body pain and suffering from 264 with the PTSD severity through an amalgamate function at 275. If, however, the claimant is older than 10, and the PTSD severity is more than 2 1/2 times the whole body

As an example, assume that the combined value at 264 is 3,066.58 and that the PTSD severity is 4,033.48. The engine determines a bound value as follows:

10

For the above example,

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20

$$\text{Result} = 0 + (1 - 0)0.215951 + (1 - 0.215951)0.284049 = 0.438659$$

25

6. Determine Permanent Dysfunction

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Because each of the elbow and forearm has only one profile, and there is no profile assigned directly

This residual level may be affected by prognoses. In the present example, no recovery prognoses are applied to the arm and forearm, and the engine therefore did not apply prognosis modifications to their curves. The arm composite, however, is assigned a 15% AMA impairment level. Assuming that this translates to a 15% dysfunction level, the engine changes the 21% residual level to 15%. The application of prognoses to body part profiles is described in detail above regarding workers' compensation processing.

Once the composite profile, including consideration for prognoses, has been determined, the engine considers the effect of future treatments and complications. In this case, the forearm has a "possible" amputation. The dysfunction level associated with an amputation is 100%. The factor associated with a probability of "possible" is 25%. Thus, the forearm dysfunction value associated with

the future treatment is 25%. Applying the forearm's grouping value, 70%, the future treatment contributes a 17.5% dysfunction to the arm composite.

The engine chooses the larger of the amalgamated residual level, 15%, and the future treatment residual level, 17.5%, in this case 17.5%.

The left arm is a component of the "upper extremities" composite body part. The arm's grouping value to this composite is 60%. Thus, the arm passes a residual dysfunction of 0.175(0.6), or 10.5%, to the upper extremities body part. Assuming that there are no other medical conditions, and therefore no other profiles, applicable to the Little Man, the residual dysfunction level for the upper extremities body part is 10.5%. The grouping value for the upper extremities body part to its composite, the Whole Body, is 1.0. Thus, the Whole Body residual dysfunction level is 10.5%.

The engine adjusts the Whole Body dysfunction value based on the claimant's age as of the case start date, i.e. the date the initial injury occurred or was diagnosed. The engine determines a multiplying factor by linear interpolation of the claimant's age against the second column of the following table:

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	<u>Age (years)</u>	<u>Factor</u>
	0	1.0
	40	1.0
	80	0.6
30	200	0.6

Assuming that the claimant in the above example is 40 or younger, the factor is 1.0, and the whole body dysfunction remains 10.5%.

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The engine considers the effect of the claimant's medical conditions on the following amenities:

Dexterity Capacity
Upper Extremity Capacity
Mobility Capacity
Personal Care Capacity

Hearing Capacity
Sight Capacity
Smell Capacity
Taste Capacity

A group of body parts is associated with each of the
15 above amenities. The engine determines the residual,
permanent and/or future dysfunction levels for the
body parts under each amenity and correlates these values
to a severity for the amenity. It then
combines the amenity severities for a total loss of
20 amenity severity. The body parts for each amenity are
listed below.

	<u>Dexterity</u>	<u>Upper Extremities</u>
	R. Wrist and Hand	R. Arm
25	L. Wrist and Hand	L. Arm
		Cervical Spine

	<u>Mobility</u>	<u>Personal Care</u>
30	R. Leg	Trunk
	L. Leg	Sight
	Thoracic Spine	Consciousness
	Lumbosacral Spine	Lymphatic System
	Pelvis	Endocrine System

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The temporary sight value is $445 \setminus 1100 = 0.4045$. The permanent sight value is the maximum of the residual dysfunction percentage, permanent severity value and future dysfunction value. Assuming that there are no impairment prognoses or future treatments/complications, the permanent sight value is 5.

The dexterity amenity includes 2 body parts: the left wrist and hand and the right wrist and hand. For each claimant, one of these body parts is preferred and one non-preferred. That is, the claimant is either left-handed or right-handed. At 302, the temporary dexterity value is (1) the sum of the preferred wrist and hand daily dysfunction levels, multiplied by 0.7, plus (2) the sum of the non-preferred wrist and hand daily dysfunction levels, multiplied by 0.3, divided by 1,100. Again, the profile for each of the two body parts is determined through the "second option" buildup routine of all profiles applicable to the left and right wrist and hand body parts and their components. Prognoses, including impairments, are considered. For simplicity, assume that the amalgamation routine results in the same profile for each of the two body parts. In the table below, column 2 represents the profile for the wrist and hand body part that is identified as preferred. Column 3 describes the dysfunction values of column 2, weighted by 0.7. Column 4 is the dysfunction profile for the wrist and hand identified as non-preferred, and column 5 describes those dysfunction levels weighted by 0.3.

	<u>Days</u>	<u>Preferred Profile</u>	<u>Preferred Weights</u>	<u>Non-Preferred Profile</u>	<u>Non-Preferred Weighted</u>
30	0	100	70	100	30
	1	100	70	100	30
	2	100	70	100	30
	4	50	35	50	15
	5	40	28	40	12

10 The permanent dexterity value is the maximum of
the preferred wrist and hand residual dysfunction
percentage, permanent severity value and future
dysfunction value, multiplied by 0.7, plus the maximum
of the non-preferred wrist and hand residual
15 dysfunction value, permanent severity value and future
dysfunction value, multiplied by 0.3. Assuming no
impairments or future treatment/complications, the
permanent dexterity value is $5(0.7) + 5(0.3) = 5$

20 c. Personal Care

 The engine determines personal care amenities at
304. The table below describes weights applied to the
dysfunction level for each day in the profile curve
for each body part under the personal care amenity.
25 Again, the profile for each body part is the "second
option" buildup of the profiles for the components of
each body part. Once each body part profile has been
determined, the engine applies the function in the
right-hand column of the table below to modify the
30 dysfunction level for each day in the profile.

<u>Body Part</u>	<u>Weighted Dysfunction</u>
Trunk	0.4 (Dysfunction Level)
Sight	1.6 (Max(Dysfunction Level - 50, 0))

	Consciousness	1.0 (Dysfunction Level)
	Lymph System	2.0 (Max(Dysfunction Level - 50.0))
5	End. System	1.6 (Max(Dysfunction Level - 50, 0))
	Urin. System	0.4 (Dysfunction Level)
	Behavior	2.0 (Max(Dysfunction Level - 50, 0))
10	Communication	2.0 (Max(Dysfunction Level - 50, 0))
	Reasoning/Memory	2.0 (Max(Dysfunction Level - 50, 0))
	Balance	2.0 (Max(Dysfunction Level - 50, 0))
15	Resp. System	2.0 (Max(Dysfunction Level - 50, 0))
	Dig. System	0.4 (Dysfunction Level)
	Card. System	2.0 (Max(Dysfunction Level - 50, 0))
20	Circ. System	2.0 (Max(Dysfunction Level - 50, 0))

For example, if each body part has the same profile as in the example above regarding sight and dexterity, the modified dysfunction level for the sight body part under personal care on day 0 is 80. On day 5, the modified dysfunction level for the communication body part is 0. On day 7, the modified dysfunction level for the digestive system is 6.

The engine then amalgamates the modified dysfunction levels for the personal care body parts, by day. For example, still assuming the same dysfunction curve for each body part as used in the above example, the dysfunction level for each personal

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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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Personal care is also affected by dexterity capacity and upper extremity capacity. Thus, in determining a temporary personal care value, the engine combines the temporary dexterity value, as

5 extremity value is multiplied by 0.6. These three values are amalgamated. Thus, assuming a temporary dexterity value of 0.4045 and a temporary upper extremity value of 0.4045, the engine amalgamates 0.58863, 0.28315 and 0.24270, for a result of 0.7767.

Assuming that the example does not include a permanent impairment or a future treatment/complication dysfunction level, the residual
25 dysfunction level for each body part is 5%. Applying the rules above, the permanent level, by body part, is:

30	Trunk	2.0
	Sight	0
	Consciousness	5
	Lymphatic	0
	Endocrine	0
	Urinary	2.0

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d. Hearing

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e. Upper Extremities

The upper extremities amenity includes the right arm, left arm and cervical spine. To determine the temporary upper extremity value at 308, the engine first determines the dysfunction profile for each of

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where

A = modified dysfunction level for preferred arm,

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C = modified dysfunction level for cervical spine

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equation.

			Preferred	Non-Preferred		
			Arm	Arm	Cervical	
5	<u>Days</u>	<u>Dysfunction</u>	<u>Dysfunction</u>	<u>Dysfunction</u>	<u>Dysfunction</u>	<u>Combination</u>
10	0	100	55	45	30	100
	1	100	55	45	30	100
	2	100	55	45	30	100
	4	50	27.5	22.5	15	50
	5	40	22	18	12	40
	6	20	11	9	6	20
	7	15	8.25	6.75	4.5	15
15	8	10	5.5	4.5	3	10
	9	5	2.75	2.25	1.5	5
	10	5	2.75	2.25	1.5	5

Summing the combination values, and dividing by 1,100, the temporary upper extremity value is 0.4045.

20 In determining the permanent upper extremity value, the engine again finds the residual dysfunction, permanent severity and future dysfunction values for each of the three body parts. For each body part, the engine chooses the maximum value.

25 Assuming that, for the above example, there are no impairments or future treatments or complications, the value for each of the three body parts is 5. The value for the preferred arm is multiplied by 0.55, and the value for the non-preferred arm is multiplied by

30 0.45. The sum of these modified values is multiplied by 0.7 and added to the cervical spine value, multiplied by 0.3. Thus, for the example above, the permanent upper extremity value is $0.7(0.55(5) + 0.45(5)) + 0.3(5) = 5.0$.

f. Mobility

The mobility processing at 310 is similar to personal care. In solving for the temporary mobility

value, the engine determines the dysfunction curve for each body part. The dysfunction level at each day for each body part profile is modified according to the following weighting rules:

5	<u>Body Part</u>	<u>Weighted Dysfunction</u>
	Right Leg/	0.7(larger dysfunction) +
	Left Leg	0.3(lesser dysfunction)
	Thoracic spine	0.4(dysfunction level)
	Lumbosacral spine	0.6(dysfunction level)
10	Pelvis	1.0(dysfunction level)
	Loin/Groin	0.5(dysfunction level)
	Buttocks	0.2(dysfunction level)
	Genital organs	0.5(dysfunction level)
	Abdomen	0.4(dysfunction level)
15	Balance	1.0(dysfunction level)
	Card. system	2.0(Max(Dysfunction level - 50,0))
	Resp. system	2.0(Max(Dysfunction level - 50,0))

As indicated in the table, the right and left legs are considered together. For each day that either the right leg or the left leg has a dysfunction level value, the engine selects the larger of the right leg and left leg values, multiplies by 0.7 and adds the result to the lesser value, multiplied by 0.3.

For example, assume that all mobility body parts, except for the left leg, have the dysfunction profile described below at columns 1 and 2. The left leg dysfunction profile is described by columns 1 and 3.

30	<u>Days</u>	<u>Body Part Dysfunction</u>	<u>Left Leg Dysfunction</u>
	0	100	70
	1	100	70
	2	100	70
	3	80	60

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	4	50	50
	5	40	45
	6	20	40
	7	15	30
5	8	10	20
	9	5	10
	10	5	5

The modified dysfunction levels for the leg combinations on days 0 and 7 are 91 and 25.5, respectively. The modified dysfunction level for the abdomen on day 5 is 16.

The remaining routine for the temporary mobility value parallels the routine for temporary personal care. For each day, the engine amalgamates the modified dysfunction values for the mobility body parts. The amalgamated results for each day are summed, multiplied by 100 (to back out the decimal conversion done prior to the amalgamation), and divided by 1,100. For the above example, the temporary mobility value is 0.7557.

The calculation for the permanent mobility value parallels that of the permanent personal care value. For each mobility body part, the engine determines (1) the residual dysfunction of the body part's dysfunction curve, modified by the applicable rule above, (2) the permanent impairment level, modified by the applicable rule above and (3) the future treatment/complication dysfunction level, modified by the applicable rule above. Assuming that there are no impairments or future treatments/complications, the residual dysfunction for each body part is 5%. Applying the rules, the permanent values for each body part are:

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Amalgamating the above values, divided by 100, the
15 permanent mobility value is 24.83.

Like hearing and sight, the taste amenity has a single body part. The temporary taste value and permanent taste value are determined at 312 in the same manner as are the temporary and permanent sight and hearing values, except that the permanent taste value is additionally multiplied by a factor of 0.4. For example, assuming that the taste body part has the same dysfunction profile as used above in the sight and hearing examples, the temporary taste value is 0.4045. The permanent taste value is $0.4(5) = 2$.

30 To determine the temporary smell value at 314,
the engine first determines the dysfunction profile
for the smell and nose body parts, again using the
"second option" buildup procedure, including
prognoses. The dysfunction level for each day in the

5 result by 1,100.

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To determine the permanent smell value, the engine finds the residual dysfunction value, impairment value and future treatment/complication value for the smell body part and the nose body part. For each body part, it selects the maximum value,

For the example above, assuming that there are no impairments or permanent treatments or complications,

The engine finds the combined temporary loss of amenity value and the combined permanent loss of amenity value at 316 and 318. Referring to the table below, columns 2 and 3 describe the temporary and permanent amenity values for the amenities described above. Dexterity and upper extremities are included in the personal care values and are, therefore, omitted.

25 The engine multiplies each temporary value, and each
permanent value, by the rate for each amenity in
column 4. These rates reflect the relative
significance of each amenity. The adjusted temporary
and permanent values are provided in columns 5 and 6,
30 respectively.

To determine the final temporary amenity value at 316, the engine amalgamates the adjusted temporary values in column 5. Prior to the amalgamation, the temporary values are divided by 100. The amalgamated

5 To convert the temporary amenity value to a severity at 320, the engine applies the amalgamated temporary amenity value to the following table:

20 amenity severity is 412.29.

The permanent amenity severity value is calculated at 320 from the following table:

Interpolating for the amalgamated permanent value for the above example, 31.995, the permanent severity is

25,196.98.

Permanent severity is defined on a scale from 0 to 150,000, whereas temporary severity is defined on a scale from 0 to 300,000. For ease of computation at 340, the temporary severity may be divided by 3,000, and the permanent severity may be divided by 1,500, providing final temporary and permanent loss of amenity severities of 0.1374 and 16.798, respectively.

10 8. Combined Severities

The engine has now calculated the following: (1) whole body pain and suffering severity, including injuries, treatments, complications, hospital/convalescent care, future treatments/complications and PTSD (2) temporary loss of amenity severity, (3) permanent dysfunction, and (4) permanent loss of amenity severity. The engine recognizes a distinction between present and future conditions in converting from severity values to general damage values, and, therefore, maintains the distinction as it combines severity values. Accordingly, the engine amalgamates whole body pain and suffering with temporary loss of amenities at 274 and then separately amalgamates permanent dysfunction and permanent loss of amenities at 276.

For example, assume that whole body pain and suffering severity is 35,678.4 on a 0-300,000 scale. Assume also that the temporary amenity severity is the value calculated above, 0.1374313. Bringing the pain and suffering severity to the same scale as the temporary amenity severity, the whole body value is divided by 3,000, resulting in 11.8928. After dividing these values by 100 and amalgamating, the combined value is 0.1201388. Multiplying by 100 to

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Assume that the whole body permanent dysfunction value is 10.50 and that the permanent loss of amenity severity is 16.797984. The engine treats the dysfunction value as a severity and amalgamates the two values. After dividing by 100, the amalgamated result is 0.2553419. Multiplying by 100, the total dysfunction severity is 25.53419.

10 The engine also combines whole body pain and
suffering severity from 275, temporary loss of amenity
severity from 268, permanent loss of amenity severity
at 270, permanent dysfunction severity from 266 and
additional allowances (described below) from 282 into
15 a combined case level severity at 277. Prior to the
combination, each of whole body pain and suffering
severity, temporary amenity severity and permanent
amenity severity is divided by 100. The model
modifies the permanent dysfunction severity from 266
20 (PDS) according to the following equation:

$$\text{mod. per. dys. sev.} = \text{PDS} + (\text{PDS}^2/100) \quad (1/2)$$

Additional allowances from 282 is a monetary value.

25 The model converts to a severity:

$$\text{Allowance severity} = \text{Allowance} / \text{multiplier}$$

where "multiplier" is the user-defined general damages
conversion multiplier described below with respect to
30 step 278. The model divides the resulting five values
by 100, amalgamates and multiplies the amalgamated
result by 100 to produce the combined case level
severity, which is reported to the user on the general

damages assessment at 206 (Figure 16).

9. Conversion to General Damages

Because general damages awards may vary from jurisdiction to jurisdiction, the engine's determination of the impact of present and future medical conditions center on severity values rather than monetary values. Accordingly, the Tuning Wizard (Figure 1) includes two user-definable multipliers that enable the engine to convert total pain and suffering and total dysfunction severity values to monetary values at 278 and 280. Prior to applying the multipliers, however, the model applies a pre-conversion factor defined by the user. The severity values from steps 274 and 276 are on a 0-100 scale. Accordingly, for both total pain and suffering and total dysfunction, the user enters pre-conversion factors, in %, for steps within the 0-100 severity scale. The default tables are:

Total Pain and Suffering		Total Dysfunction	
<u>Severity</u>	<u>Pre-Conv. Factor</u>	<u>Severity</u>	<u>Pre-Conv. Factor</u>
0	100	0	100
100	100	100	100

That is, the pre-conversion factor is 1 for all severities. Assume, however, that the initial pre-conversion factor is set to 0 in the total dysfunction table. By linear interpolation, the total dysfunction severity calculated above, 25.53419, is multiplied by 0.2553419 before application of the general damages multiplier.

The user may define the pain and suffering multiplier, and the dysfunction multiplier, through

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At 284, the engine determines a likely range of general damages for the case. The high end of the range is equal to the sum of the total pain and suffering general damages contribution, the total dysfunction general damages contribution, and the allowance general damages contribution, rounded to the nearest 100. For the above example, the general damage's high end is $\$36,041.64 + \$38,301.29 + \$447.50$, rounded to nearest \$100, or \$74,800.

The low end of the general damages range is derived from discount percentages entered by the user. The user may enter a discount percentage for successive monetary ranges, for example 15% for the first \$1,000,000, 20% for the next \$500,000, etc. The user defines both the monetary ranges and the discount percentages. The engine sums the total pain and suffering and total dysfunction general damages contributions, discounts by the appropriate percentage and adds to the adjusted disfigurement allowance. Continuing the example, assume that the user has entered a 15% discount percentage for a 0 - \$1,000,000 range. The sum of the total pain and suffering and

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number of weeks the claimant is out of work and multiplies by the salary to determine past economic loss attributable to this time period.

If the claimant is unable to work, and there is
5 no estimate of the date on which he will be able to return to work, the engine determines a return-to-work date using the workers' compensation processing described above. This requires that the user enter occupation data or point to an occupation in the
10 dictionary of occupational titles. In estimating a time-off-work period, the engine stretches all applicable dysfunction profiles to their stabilization days as in common law processing. It does not consider the possibility of alternate occupations.
15 Assuming that the user enters a start date for the time-off-work period, the engine determines the end date as the latest task date for the Task Wizard occupation or as the latest DOT occupation activity date. The engine then calculates the past economic
20 loss value for the period, based on the entered salary and pay period information.

If it is expected that the claimant will never return to work, or if in executing the time-off-work estimate the engine determines that the claimant will
25 never return to work, the engine provides past economic loss up to the case run date and prompts the user to enter sufficient information for an assessment of future economic loss, as described below. The user may also directly define a past economic loss period
30 extending from the earliest injury date to present and allocate later salary loss to the future economic loss assessment.

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E. Determine Future Economic Loss

The engine determines future economic loss at 204. Generally, future economic loss is an assessment of the likelihood that the claimant will not be able to work in the same occupation, or will not be able to work at all, for some period in the future. The user enters start and end dates for the future economic loss period, the loss amount and the applicable salary frequency, a capitalization rate and a vicissitudes rate.

The start and end dates depend on the type of loss that the claimant is expected to suffer. For example, the claimant may be able to continue his occupation at present but, due to the injury, is expected to work 10 fewer years than he would if the injury had not occurred. Assuming that the claimant would normally expect to work 35 years from the present, the start and end dates would be 25 years and 35 years, respectively, from the present day.

The loss amount is the difference between what the claimant would be expected to earn during the loss period if the injury had not occurred and what the claimant is expected to earn during the loss period after the injury has occurred. For example, if the claimant is expected to be able to earn \$600 per week after the injury, but would have been expected to earn \$800 a week if the injury had not occurred, the loss amount is \$200. The pay period would be weekly. The capitalization rate is a discount rate used to bring the future loss to a present value. The vicissitudes rate reflects the likelihood that the claimant would have lived long enough to attain his expected income had the injury not occurred.

The user also enters a code that reflects the

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likelihood that the claimant will suffer the future economic loss. In one embodiment, the options are "possible," "probable" and "definite." These likelihoods correspond to probability rates of 0.25, 0.6 and 1.0, respectively.

As an example, assume that the loss amount is \$100 for a weekly pay period, the loss start date is March 27, the loss end date is April 6, the capital rate is 5%, the vicissitudes rate is 15% and the case run date is March 27. The daily loss amount is \$14.29. The daily capitalization rate is $(1 + (5/100))^{*(1/365)} = 1.0001336806$. There are 10 days in the payment period.

The engine determines an annuity rate for each day in the loss period. The annuity rate for each day k is.

$$\text{annuity rate } (k) = \text{annuity rate}(k - 1) + 1/(\text{daily capitalization rate})^k,$$

where annuity rate $(0) = 0$.

The engine multiplies the daily loss amount by the annuity value for the last day in the period, day 10, in this case 9.9926515. The result is 142.75.

If the future economic loss start date is greater than the case run date, the result of the previous step is multiplied by a factor of:

$$(1/\text{daily capitalization rate})^{*(\text{future economic loss start date} - \text{case run date})}.$$

In this case, the future economic loss start date and the case run date are the same, and the annuity value therefore remains 142.75.

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5 The engine then discounts the annuity value by
the vicissitudes rate. Here, the vicissitudes rate is
equal to 15%, and the engine therefore multiplies the
annuity value by 0.85. Rounding to the nearest
dollar, the annuity value is 121. Thus, the future
10 economic loss amount for this assessment is \$121.

While preferred embodiments of the invention have been described above, it should be understood that any and all equivalent realizations of the present invention are included within the scope and spirit thereof. For example, it should be understood that there can be other suitable capacity level profile definitions, prognoses algorithms and criteria, and severity computations. Thus, the embodiments are presented by way of example only and are not intended as limitations upon the present invention, and those of ordinary skill in this art should understand that many modifications may be made. Therefore, it is contemplated that any and all such embodiments are included in the present invention as may fall within the literal or equivalent scope of the appended claims.